Journal of Knowledge Management

A framework to identify knowledge actor roles in enterprise social networks

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Abstract

Purpose – *Enterprise social networks (ESN) are increasingly used by companies to reinforce collaboration and knowledge sharing. While prior research has investigated ESN use practices, little is known about potential user roles emerging on these platforms. Against this backdrop, this paper develops an ESN knowledge actor role framework.*

Design/methodology/approach – *The framework is constructed based on a systematic review of literature covering knowledge worker role typologies, user roles identified in public online social spaces as well as findings from ESN research.*

Findings – *The ESN knowledge actor role framework distinguishes eight contributing and two reading roles. It describes the associated participation behaviours and establishes metrics to identify the roles.*

Research limitations/implications – *Providing a notion of knowledge management-related roles in ESN, the framework enables a better understanding of knowledge processes and the involved actors. Moreover, the paper advances the field of ESN data analytics by designing a set of ESN metrics to characterise user behaviour.*

Practical implications – *Understanding ESN user roles, in particular regarding their knowledge contributions to the platform, can improve knowledge transparency in companies. The framework may usefully support the identification and management of critical knowledge resources and support decision-making in the areas of human resources management and knowledge management.*

Originality/value – *Providing a platform for knowledge-intensive interactions as well as record of user activities, ESN are well suited to observe and identify knowledge actor roles emerging in this context.*

Keywords *User behaviour, Knowledge management, Enterprise social network, Role analysis, User roles*

Paper type *Research paper*

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1. Introduction

Enterprise Social Networks (ESN), that is, internally accessible social networking services, are increasingly used in companies to support knowledge management (KM) and collaboration. Providing a conversational space for knowledge work (Riemer and Scifleet, 2012), ESN users perform various KM-related interactions, such as brainstorming or discussing ideas[1]. While prior work (Richter and Riemer, 2013) has investigated the ways in which users draw on ESN to communicate and share knowledge, little is known about the *user roles* that may emerge on these platforms. In this regard, certain behavioural patterns and types of knowledge contributions may be characteristic for a group of users, thus leading to the emergence of distinct user roles. Because user interactions are digitally stored in the ESN back end (Behrendt *et al.*, 2014a), the analysis of the accumulated data might be well suited for the identification of use patterns of different KM-related roles, that is distinct *knowledge actor roles*, in ESN. This article hence addresses the following research question:

RQ. Which knowledge actor roles are likely to emerge in ESN and how can they be characterised using ESN metrics?

Received 14 October 2016
Revised 18 March 2017
Accepted 12 May 2017

Building upon the authors' prior work on this topic (Hacker *et al.*, 2017c, 2017d), this article develops a conceptual framework that distinguishes ten ESN knowledge actor roles, which are associated to varying degrees with different behavioural dimensions. Each dimension is operationalised based on a set of ESN metrics that enable its measurement using ESN data, and thus, the identification of the roles using ESN data. The framework is grounded on KM literature as well as scholarly works on user roles in online social spaces and ESN. Specifically, the knowledge worker role typology by Reinhardt *et al.* (2011) is adapted for the context of ESN based on findings on user roles in public online social spaces as well as findings from ESN research.

Several gaps in the existing literature are addressed in this article. On the one hand, the topic of knowledge worker roles and methods to identify these roles have received little attention in KM research (Caddy, 2007; Reinhardt *et al.*, 2011). Because KM-related activities in organisations often occur in informal organisational structures, the participating actors are difficult to observe and to identify (Caddy, 2007; Fischbach *et al.*, 2010). On the other hand, ESN provide a record of KM-related user interactions. Yet, a typology of the user roles that emerge in ESN is missing in the current body of literature (Trier and Richter, 2015). Thus, this article contributes to theory by bridging the gap between research on knowledge worker roles in offline settings and research on roles in public online social spaces. Providing a notion of KM-related roles in ESN, the framework lays the groundwork for a better understanding of knowledge processes and actors, which is an important task in the management of knowledge work (Newell *et al.*, 2009). Further, the field of ESN analytics is advanced by developing a quantitative approach to identify ESN user roles. As such, a quantitative approach facilitates the analysis of larger systems and likewise helps to reduce the complexity of such systems to the "more important" actors (Zygmunt, 2014).

For practitioners, the developed framework may usefully support the identification and management of critical knowledge resources. Because of knowledge interactions occurring in informal organisational structures, many organisations lack an overview of "what they know" (Newk-Fon Hey Tow *et al.*, 2012). As such, "knowledge" does not only reflect employees' technical expertise, but also how and with whom they interact while performing knowledge work. The framework enables the identification of differentiated roles, such as *initiators* and *helpers*, which might be of varying importance in different organisations. Applying the framework, organisations may indeed come to an understanding which (types of) actors they consider as critical. Such information can support decision-making in human resources management, for example, for staffing teams, spotting talented personnel or creating retention strategies (Caddy, 2007; Parise, 2007).

This article is structured as follows: Section 2 informs the theoretical background of this article by introducing different KM perspectives and research on KM-related roles in organisations. Next, Section 3 provides findings from the literature regarding roles in online social spaces and KM-related ESN use practices, and gives an overview regarding ESN data dimensions. As shown in Figure 1, the contents of both Section 2 and Section 3 inform the construction of the ESN knowledge actor role framework, which is introduced in Section 4. The final sections discuss and summarise the findings of this article.

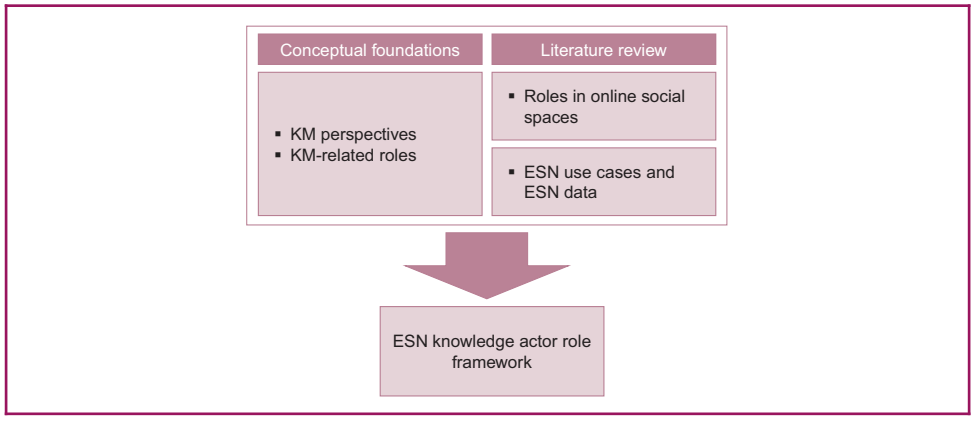
2. Conceptual foundations

Forming the theoretical background of this article, the following sections contrast perspectives on knowledge and provide an overview of KM-related roles in organisations.

2.1 Perspectives on knowledge

With regard to the study of knowledge and knowledge work in organisations, two main perspectives can be distinguished (Cook and Brown, 1999): the possession perspective and the practice perspective. Scholars taking up the *possession* perspective (Nonaka, 1994) consider knowledge as an object that is held by an individual knower. To share and

Figure 1 Structure of the article



retain this knowledge, it needs to be extracted from the individual and explicated, so that others can access it. Conversely, scholars adopting the *process* or *practice* perspective on organisational knowledge argue knowledge to be created and shared through social interactions between individuals (Brown and Duguid, 2001; Cook and Brown, 1999; Orlikowski, 2002). In this regard, individuals are seen as mediators who actively and constantly (re)produce knowledge in the organisational practice.

ESN represent an alternative platform – besides other computer-mediated as well as unmediated spaces – for knowledge workers to perform knowledge (inter)actions (Riemer and Scifleet, 2012), that is, "processes and practices through which knowledge is shared, integrated, translated and transformed" (Newell *et al.*, 2009, p. 26). Rather than being used as knowledge repositories, ESN support the social and communicative aspects of knowledge work. In accordance with the authors' prior work on KM-related roles in ESN (Hacker *et al.*, 2017d), this article adopts the knowledge-in-practice perspective because it more adequately reflects how knowledge work occurs on ESN. Which KM-related roles, however, are likely to emerge in this context?

2.2 Knowledge management-related roles in organisations

While knowledge work is a prominent topic in KM research, relatively few authors investigate the different roles that knowledge workers assume during their daily work (Reinhardt *et al.*, 2011). In this regard, existing typologies of knowledge worker roles tend to focus on specific activities that knowledge workers could perform, for example, *generating*, *transforming* and *using* knowledge (Geisler, 2007), or *finding*, *packaging*, *creating*, *distributing* and *applying* knowledge (Davenport, 2005, pp. 28-30). The corresponding roles, such as *knowledge packagers* and *knowledge distributors*, imply a possession perspective of knowledge. Because ESN support the social and communicative aspects of knowledge work, which is inherent to the knowledge-in-practice perspective, typologies based on the possession perspective are not directly applicable for identifying knowledge actor roles in ESN.

However, the knowledge worker role typology by Reinhardt *et al.* (2011) as well as research on organisational social networks may be feasible to inform the development of the ESN knowledge actor role framework. Based on a literature review and a survey, Reinhardt *et al.* (2011) developed a typology that proposes ten knowledge worker roles, among them *controllers*, *helpers* and *solvers*. Each of the knowledge worker roles is linked to a set of actions out of 13 specified knowledge actions (Reinhardt *et al.*, 2011 Table II) that are considered as the basic components of knowledge work. *Solvers*, for instance, tend to engage in the actions *acquisition* of knowledge, *analysing* information and *information search*.

Moreover, research on informal organisational structures identifies different roles in organisations. Informal organisational relationships commonly reflect knowledge interactions between employees, such as receiving information from a coworker or providing someone else with information (Cross *et al.*, 2001). Analysing information flows, *central connectors*, *boundary spanners*, *information brokers* and *peripheral specialists* have been identified as key roles in informal networks (Cross and Prusak, 2002; Parise *et al.*, 2006). The method of organisational social network analysis (SNA) is refined by Helms and Buijsrogge (2005) who identify the roles *knowledge creator*, *knowledge sharer* and *knowledge user* by performing knowledge network analysis.

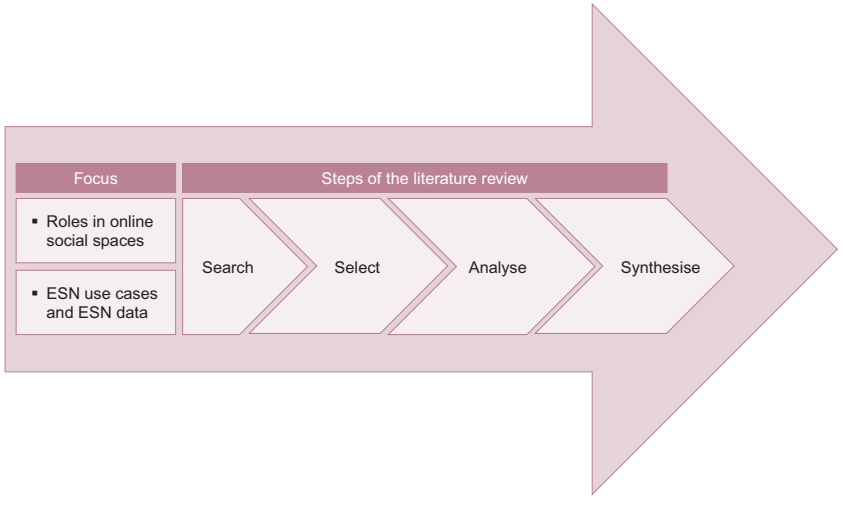
With regard to the development of the ESN knowledge actor role framework, the knowledge worker role typology by Reinhardt *et al.* (2011) shows the various roles involved in knowledge work and suggests specific actions that these roles perform. However, some of the knowledge worker roles, such as *helper* and *solver*, engage in the same knowledge actions to similar extents and might be difficult to differentiate based on a quantitative analysis of ESN data (Hacker *et al.*, 2017d). Furthermore, the typology by Reinhardt *et al.* (2011) focuses on the actions of individual roles but does not consider the interplay between different roles. Actions performed on a certain role, such as being frequently asked for advice, are not reflected in the framework (Hacker *et al.*, 2017d). In this regard, studies on roles in informal organisational structures (Cross and Prusak, 2002) and the knowledge network analysis approach (Helms and Buijsrogge, 2005) place more emphasis on the communicative and interactive aspects of knowledge work which is required for the ESN knowledge actor role framework.

3. Literature review

The introduced KM-related roles in organisations provide a conceptual basis for the ESN knowledge actor role framework. To be able to construct this framework, however, more information regarding roles in online social spaces as well as information on how ESN are used in organisational practice is needed.

As shown in Figure 2, the contents of both Section 3.1 and Section 3.2 are compiled by reviewing information systems (IS) literature (vom Brocke *et al.*, 2015)[2]. As such, scientific databases were searched for relevant literature, suitable publications were selected,

Figure 2 Literature review approach



Source: Based on vom Brocke *et al.* (2015)

analysed and synthesised to derive the necessary inputs for constructing the ESN knowledge actor role framework.

Section 3.1 introduces findings of the literature review on roles in online social spaces. It focuses on social roles found in prior research as well as behavioural features of roles and metrics used to operationalise these features. Findings of the literature review regarding ESN (Section 3.2) reveal ESN use practices relevant for knowledge work and insights regarding the analysis of ESN data.

3.1 Roles in online social spaces

According to Welser *et al.* (2007), roles in online settings are defined as "a combination of particular sets of behavioural, meaningful, and structural attributes". Roles can be characterised by "structural signatures" which reflect their position in a social network and their participation behaviour in terms of making contributions in an online community (Gleave *et al.*, 2009; Welser *et al.*, 2007). Social roles have been studied in various types of online communities, such as discussion forums (Angeletou *et al.*, 2011; Chan *et al.*, 2010), newsgroups (Fisher *et al.*, 2006; Welser *et al.*, 2007) and blogs (Gliwa *et al.*, 2013; Smith Risser and Bottoms, 2014). For instance, Rowe *et al.* (2013) determine *focus dispersion*, *initiation*, *content quality* and *popularity* as distinct behaviour dimensions of users of the SAP Community Network. Using these dimensions, they recognise the roles of *focused expert participants* and *focused expert initiators*, for instance. While the first provide high quality answers in select forums, the latter are likewise focused on a few topics but tend to start rather than to participate in discussions.

The topic of user roles has not yet received a lot of attention in ESN research. Holtzblatt *et al.* (2013), for instance, classify ESN users based on log data along two dimensions, that is, based on their level of contributions and regularity of logging on the platform. Regarding the first dimension, they differentiate between *active contributors*, *moderate contributors* and *readers*. As to the second dimension, they distinguish *active* from *occasional* users. Generally, researchers differentiate between users who contribute (valuable) content to the ESN (Beck *et al.*, 2014; Berger *et al.*, 2014; Cetto *et al.*, 2016) and users who tend to seek or consume the information posted by others (Beck *et al.*, 2014; Cetto *et al.*, 2016). These roles are seen as mutually interdependent (Trier and Richter, 2015). In addition, Cetto *et al.* (2016) find evidence for a role called *matcher*. Users classified as *matchers* show a relatively balanced amount of write and read accesses on an ESN.

The features used to model user behaviour vary depending on the objectives of the studies and the investigated platforms. To get an overview of relevant behavioural features, the metrics employed in the selected publications were compared and categorised into 14 dimensions. Table I gives an overview of the derived categories and shows, by way of example, metrics that can be used to quantify the different dimensions.

To conclude, existing studies on user roles in ESN ground their role concepts on relatively few behavioural dimensions and metrics. Features such as initiating vs participation, asking vs replying, dispersion and connectedness are frequently used to model user behaviour in public online social spaces (Table I). Hence, these features and their translation into metrics can usefully inform the construction of the ESN knowledge actor role framework.

3.2 Enterprise social networks use cases and enterprise social networks data

ESN are web-based intranet platforms that rely on Web 2.0 technology and are implemented within organisations (Kügler *et al.*, 2015; Leonardi *et al.*, 2013). Because of features generally available in ESN, users can perform *passive*, that is, reading or consuming, actions such as retrieve information from the platform using a search feature, browse the platform's content and subscribe to the updates of other users via features such as *following* (Le Clair *et al.*, 2016; Gotta *et al.*, 2015). Furthermore, users can *actively*

Table I Overview of the extracted behavioural dimensions

Dimension	*Example references*	*Description*	*Example metrics*
Network structure and connectedness	Chan *et al.* (2010), Füller *et al.* (2014)	Embeddedness of a user in the social network graph, which can be constructed based on, e.g. following or reply relationships	In-degree Out-degree Betweenness centrality Clustering coefficient
Volume	Pfeil *et al.* (2011), Füller *et al.* (2014), Graham and Wright (2014)	Quantifies the overall volume of contributions and activity of a user in an online community	Number of messages Average number of posts per day
Verbosity	Junquero-Trabado and Dominguez-Sal (2012)	Characterises the length of the contributions by a user	Average number of words in the documents published by a user
Regularity	Viegas and Smith (2004), Holtzblatt *et al.* (2013)	Degree to which a user continuously engages with the platform	Number of active days Percentage of days that users logged in
Quality	Füller *et al.* (2014), Rowe and Alani (2012)	Degree to which the information posted by a user is useful to others	Mean utility of answers Average points per post awarded to the user
Initiating	Rowe *et al.* (2013), Viegas and Smith (2004)	Degree to which a user starts new conversations	Proportion of threads started by a user Number of initiated threads
Focus dispersion	Chan *et al.* (2010), Rowe and Alani (2012)	Degree to which a user communicates across different topic areas	Average number of posts per thread Number of threads contributed to
Engagement	Rowe and Alani (2012), Rowe *et al.* (2013)	Degree to which a user communicates with diverse sets of users	Proportion of users a user has replied to
Influence	Himelboim *et al.* (2009), Junquero-Trabado and Dominguez-Sal (2012)	Degree to which a user exerts influence on the flow of information	Replier share Average depth of propagation of a document posted by a user
Popularity	Chan *et al.* (2010), Himelboim *et al.* (2009)	Degree to which a user is recognised and renowned	Proportion of users that have replied to a user Number of received messages
Reciprocity	Angeletou *et al.* (2011), Junquero-Trabado and Dominguez-Sal (2012)	Degree to which interactions of a user are mutual	Bi-directional threads ratio Number of reciprocal relationships of a user
Asking questions	Furtado *et al.* (2013)	Degree to which users use a platform to seek information	Number of questions posted
Commenting and replying	Welser *et al.* (2007), Viegas and Smith (2004)	Degree to which a user replies to the posts by other users, e.g. answers a question	Number of answers posted Number of comments posted
Thanking	Graham and Wright (2014)	Degree to which a user sends thank-you messages to other users	Percentage of thank-you posts Average number of thanks per post

participate in ESN by making contributions to the platform's discussion thread. Within the main stream or in groups, the discussion thread enables users to engage in communicative events (Richter and Riemer, 2013), such as initiating a conversation, replying to other users' updates, liking and rating the content posted by others, tagging other users and topics as well as sharing files (Le Clair *et al.*, 2016; Gotta *et al.*, 2015).

User communication and interactions on ESN lead to digital traces that persist over time (Leonardi *et al.*, 2013). Accumulated in the ESN back end, digital traces are records of user activity that include usage data, data on the posted content as well as data on relations between users (Behrendt *et al.*, 2014b).

ESN data can be analysed using both qualitative and quantitative methods (Behrendt *et al.*, 2014b). Qualitative analyses of the content of the messages posted to the discussion thread facilitate an understanding of why and how ESN users engage with the platform (Riemer *et al.*, 2011a; Riemer and Richter, 2010). In this regard, a comprehensive overview of ESN usage is given by Richter and Riemer (2013), who identified eleven ESN use cases based on findings derived from five case studies: *Discussion and opinion*, *event notifications*, *idea generation*, *informal talk*, *information storage*, *input generation*, *meeting organisation*, *problem solving*, *social praise*, *status update* and *work coordination* (see Richter and Riemer (2013) for a full description of each use case).

Quantitative analyses, on the other hand, can be performed based on usage data that quantitatively characterises user activities or relational data resulting from user interactions (Behrendt *et al.*, 2014b). While usage data enables the development of metrics, for example, *number of status updates created (per month*), relationships between users and the structural position of individuals can be studied using SNA.

Even though little is known about specific user roles in ESN, the work by Richter and Riemer (2013) shows that users engage in various and distinct use cases in ESN. Furthermore, the use cases reflect the interactive nature of ESN platforms: most of them include a sender, who initiates a conversation by *asking* for something, for example, for an opinion or help within *input generation*, and others who *provide* an answer for this request (Riemer *et al.*, 2011b; Riemer and Scifleet, 2012). Relationships between users emerge explicitly via following each other and implicitly via shared interactions (Behrendt *et al.*, 2014b; Leonardi *et al.*, 2013) or by replying to each other.

Based on the findings on user roles in online social spaces and the findings about ESN use cases, this article suggests the emergence of different roles on ESN. The digital traces stored in the ESN back end enable the development of metrics that allow for a quantification of their behaviours.

4. Enterprise social networks knowledge actor role framework

The ESN knowledge actor role framework is constructed by drawing on literature regarding KM-related roles in organisations (Section 2.2), research on roles in online social spaces (Section 3.1) as well as findings from ESN (Section 3.2).

From a KM perspective, the knowledge worker role typology by Reinhardt *et al.* (2011) provides a conceptual basis for identifying knowledge actor roles in ESN. However, focusing on actions rather than interactions, the typology does not sufficiently consider the social nature of knowledge work which is inherent to knowledge work on ESN (Riemer and Scifleet, 2012). In this regard, organisational SNA places emphasis on knowledge interactions by considering, among others, advice-seeking and problem-solving relationships between individuals. In addition, SNA provides metrics to characterise the relationships between individuals and the position of individuals in the emerging networks. Thus, similar interactions on ESN can be considered to identify roles. Research on roles in online social spaces reveals roles, behavioural dimensions and metrics applicable to online platforms somewhat similar to ESN. Hence, the design of and findings from these related studies inform the construction of the framework. Moreover, findings from ESN research illustrate how knowledge work is performed on ESN. The fact that some of the use cases found by Richter and Riemer (2013) overlap with knowledge actions identified by Reinhardt *et al.* (2011) and in organisational SNA, for example, problem-solving, indicates findings from offline settings to be generally applicable to ESN. In this regard, the use cases complement the findings from offline settings as they reflect conversational aspects, for instance, related to discussing matters of interest and brainstorming ideas, and social aspects of knowledge work, such as acknowledging an individual for an achievement or engaging in informal talk. Furthermore, descriptions and examples of conversations

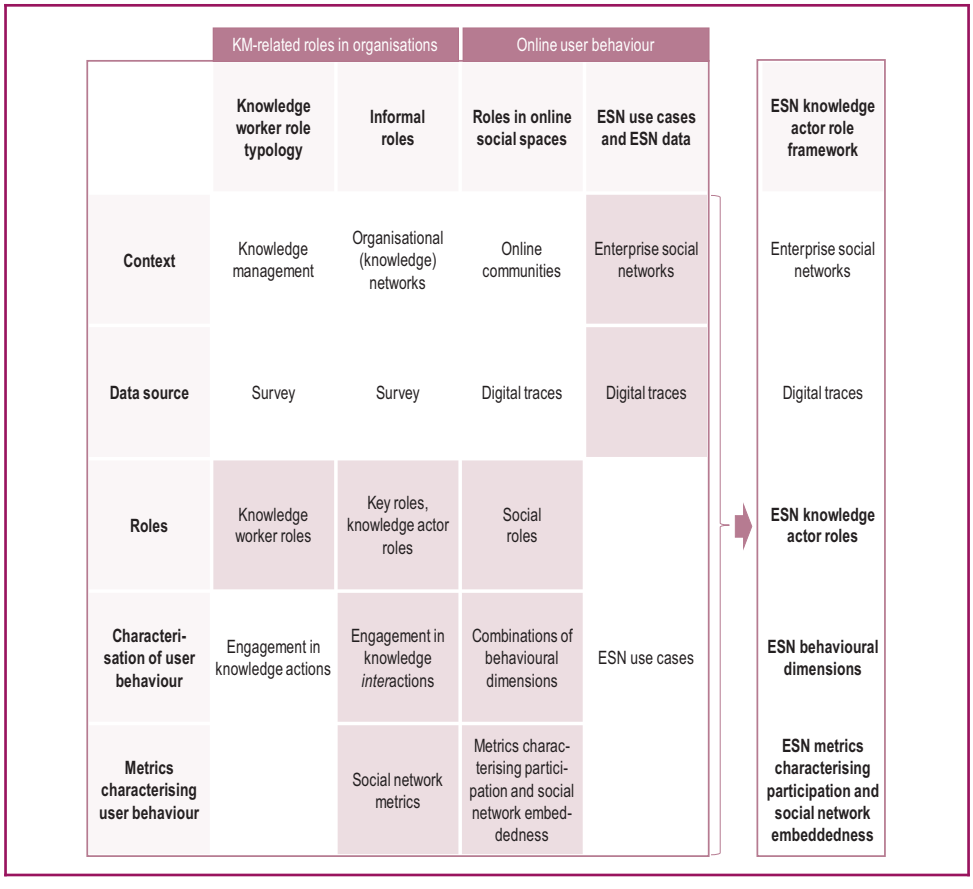
classified according to the different use cases provided in these studies (Richter and Riemer, 2013) inform the design of suitable metrics.

Figure 3 summarises aspects of the different research areas informing the development of the ESN knowledge actor role framework. In this regard, key aspects are highlighted.

4.1 Specification of enterprise social networks knowledge actor roles

The knowledge worker role typology by Reinhardt *et al.* (2011) served as the starting point to specify the ESN knowledge actor roles. First, roles that show a lot of overlap, such as the *learner* and the *retriever*, were merged to avoid redundancies and facilitate the identification of roles using ESN metrics (Hacker *et al.*, 2017d). Second, the reduced set of knowledge worker roles was compared with the ESN use cases (see Section 3.2) as well as with user roles recognised in online social settings (see Section 3.1), for example, discussion boards, newsgroups and ESN. As a result, elements of some of the knowledge worker roles by Reinhardt *et al.* (2011), such as *helper* and *solver*, are reflected in more than one ESN knowledge actor role because more differentiated role concepts are suggested by social media research (Rowe *et al.*, 2013). Moreover, the knowledge worker role typology was extended by roles solely identified in online social settings, such as the *initiator*, the *debater* and the *expert*, to take into account the social and communicative aspects of knowledge work (Hansen *et al.*, 1999). The ESN knowledge actor role framework does not consider roles focusing on a user's overall level of engagement with the platform rather than particular activities in the context of knowledge work. While roles such as *power users* [e.g. *masters* (Füller *et al.*, 2014)] or *occasional users* [e.g. *passive users* (Hautz *et al.*, 2010)] are likely to exist on ESN, they cannot be linked to particular knowledge worker roles or ESN use cases based on the review of the literature.

Figure 3 Inputs for constructing the ESN knowledge actor role framework



The ESN knowledge actor framework differentiates between *contributing* and *reading* knowledge actor roles. *Contributing* roles (Table II) actively participate in the ESN by submitting content, such as messages or files, to the platform and reacting to the other persons' posted content by replying to it. *Reading* roles (Table III) do not submit any content but follow what is happening on the platform. They are understood as invisible actors who may assume important roles in transferring knowledge between online and offline contexts in the organisation (Cranefield *et al.*, 2011, 2015). The group of *non-users*, who are registered on the ESN but never actually log on, is not included in the framework.

Table II and III give an overview of the eight *contributing* ESN knowledge actor roles and the two *reading* roles, respectively, and show the associated roles identified in KM and social media research. Moreover, Table II illustrates the related ESN use cases, differentiating between *asking* and *providing* (see Section 3.2) and maps the knowledge actor roles to the extracted behavioural dimensions (Table I).

On the one hand, the associated behavioural dimensions are based on the ESN use cases related to a role. In this regard, Table AII (see appendix) connects the ESN use cases identified by Riemer *et al.* (2011b) and Riemer and Scifleet (2012) with relevant behavioural dimensions of social roles in online settings (Table I) by considering the digital traces resulting from engaging in the respective ESN use cases (see Section 3.1). For instance, asking for *opinions* or *ideas* is related to the behavioural dimensions *initiating* and *asking questions*. The provision of the respective answers, on the other hand, is related to *commenting and replying*. Table AI includes three behavioural dimensions going beyond those behavioural dimensions extracted from prior work (printed in bold type) because the corresponding use cases could not be reasonably linked to any of the extracted behavioural dimensions: *Information sharing*, *linking* and *chatting*. While *information sharing* describes a user's propensity to disseminate information in the network, for example, by sharing links or factual information, *linking* is related to connecting and organising information, for instance, by adding topic tags to a post. *Chatting* describes the degree to which a user engages in informal talk with other members of the community.

On the other hand, the behavioural dimensions connected to a certain role are not only because of the ESN use cases associated with a role, but likewise reflect the patterns that emerge because of an actor engaging in certain ESN use cases. As such, they mirror characteristics attributed to the corresponding roles in online social spaces. *Initiators*, for instance, start new conversations and therefore exhibit behaviours related to *initiating* and *asking questions*. Yet, they are also associated with *popularity* because they are conceptualised as role actors who start interesting and ongoing conversations that attract a number of answers. Thus, it is the combination of different behavioural dimensions reflecting the users' behaviours as well as how other users react to their contributions that make up a certain role. As for the two *reading* roles, Table III shows the ESN features associated with passive usage instead of ESN use cases, which reflect active usage only. The following paragraphs provide detailed descriptions of each role.

Initiator. The feature *initiating* is frequently used to model user behaviour in public online social spaces (Chan *et al.*, 2010). Trier and Richter (2015) identify *discourse drivers* and Richter and Riemer (2013) suggest certain persons to be initiating conversations related to the use cases *idea generation* and *discussion and opinion*. Individuals acting as *initiators* are suggested to start conversations in ESN, for example, by asking for an opinion or introducing an idea, rather than to participate in conversations and answer requests by others. Interacting with a relatively high number and diverse set of users, they are well-known in the network and receive many answers to their status updates.

Debater. The feature *commenting and replying* is the counterpart of *initiating* and has been found to be discriminating in public online settings (Rowe *et al.*, 2013). Drawing on these findings, the *debater* tends to join ongoing conversations initiated by others rather than to start new conversations. *Debaters* are suggested to contribute a number of replies to a

Table II Contributing ESN knowledge actor roles

ESN knowledge actor role	*Related roles (knowledge management)*	*Related ESN use cases (Richter and Riemer, 2013)*	*Example related roles (social media)*	*Related behavioural dimensions*
Initiator		Idea generation (ask); discussion and opinion (ask)	Popular initiator (Chan *et al.*, 2010); discussion starter (Hansen *et al.*, 2010); discourse driver (Trier and Richter, 2015)	Initiating; asking questions; popularity
Debater		Discussion and opinion (provide); idea generation (provide)	Debater (Viegas and Smith, 2004); discussion person (Welser *et al.*, 2007)	Initiating; asking questions; commenting and replying; verbosity; focus dispersion; volume; engagement
Sharer	Sharer (Reinhardt *et al.*, 2011)	Input generation (provide)	Value-adding user (Berger *et al.*, 2014); knowledge contributor (Beck *et al.*, 2014); giver (Cetto *et al.*, 2016)	Initiating; information sharing; popularity; quality
Coordinator	Organiser (Reinhardt *et al.*, 2011)	Event notification (provide); work coordination (ask/provide); meeting organisation (provide); information storage (provide)		Initiating; asking questions; commenting and replying; verbosity; information sharing; linking; popularity; volume
Seeker	Learner, retriever (Reinhardt *et al.*, 2011); knowledge user (Helms and Buijsrogge, 2005)	Problem-solving (ask); social praise (provide)	Knowledge seeker (Beck *et al.*, 2014); question asker (Fisher *et al.*, 2006; Viegas and Smith, 2004)	Initiating; asking questions; commenting and replying; thanking; linking; popularity
Helper	Helper, solver (Reinhardt *et al.*, 2011); knowledge creator (Helms and Buijsrogge, 2005)	Problem-solving (provide)	Value-adding user (Berger *et al.*, 2014); knowledge contributor (Beck *et al.*, 2014); answer person (Fisher *et al.*, 2006; Viegas and Smith, 2004); giver (Cetto *et al.*, 2016)	Commenting and replying; information sharing; linking; volume; verbosity; regularity; quality
Expert	Helper, solver (Reinhardt *et al.*, 2011)	Problem-solving (provide)	(mixed/distributed) expert (Rowe *et al.*, 2013); elitist (Chan *et al.*, 2010)	Commenting and replying; information sharing; linking; popularity; focus dispersion; verbosity; volume; reciprocity; quality
Networker	Networker (Reinhardt *et al.*, 2011)	Status updates (provide); problem-solving (provide); discussion and opinion (provide); informal talk (provide)	Socialiser (Füller *et al.*, 2014); social networker (Welser *et al.*, 2009)	Initiating; asking questions; commenting and replying; verbosity; information sharing; linking; chatting; popularity; focus dispersion; volume; engagement; regularity; network structure and connectedness

Table III Reading ESN knowledge actor roles

ESN knowledge actor role	*Related roles (knowledge management)*	*Example related roles (social media)*	*Related ESN features (for consuming content)*
Linker	Linker, learner (Reinhardt *et al.*, 2011)	Reader (Holtzblatt *et al.*, 2013); guest/visitor (Herrmann *et al.*, 2004); taker (Cetto *et al.*, 2016)	Searching; reading
Observer	Controller, tracker (Reinhardt *et al.*, 2011)	Reader (Holtzblatt *et al.*, 2013); guest/visitor (Herrmann *et al.*, 2004)	Reading; following

single thread (Viegas and Smith, 2004), for example, providing feedback for an idea or further questions, and thus, promote the discussion. Their messages may be quite verbose because they provide detailed feedback.

Sharer. The ESN knowledge actor role *sharer* is based on both findings from social media (Beck *et al.*, 2014; Füller *et al.*, 2014) and KM research (Reinhardt *et al.*, 2011). Similar to *initiators*, *sharers* are suggested to start rather than join conversations. However, they focus on spreading information objects in the network, for example, through sharing external input by posting URLs to relevant newspaper articles or files (Richter and Riemer, 2013). Compared to *initiators*, they receive less and shorter replies to their posted content. If the posted content is useful to the wider community, *sharers* might receive thank-you messages or positive votes.

Coordinator. While not applicable in public online settings, several ESN use cases identified by Richter and Riemer (2013), for example, *event notification* or *meeting organisation* indicate the role of *coordinators*. Further, the role reflects elements of the knowledge worker role *organiser* specified by Reinhardt *et al.* (2011). *Coordinators* are suggested to perform actions related to scheduling events and keeping others informed about these events. They tend to initiate conversations by posting a relatively short message, often including URLs, numeric characters or tagged topics. Because *coordinators* are suggested to coordinate work, they often tag other persons in their messages, for example, when delegating tasks (Richter and Riemer, 2013). *Coordinators* receive a number of short replies to their posted content.

Seeker. Evidence for *seekers* can be found in both social media research (Trier and Richter, 2015), as well as in the KM literature (Helms and Buijsrogge, 2005; Reinhardt *et al.*, 2011). The role *seeker* is suggested to actively request information from the ESN community, for example, by posting a question in a status update to solve a work-related problem (Richter and Riemer, 2013). Hence, *seekers* mainly start new conversations with a question. The number of answers that they receive may vary depending on the size of the *seeker's* network and the complexity of the asked question. *Seekers* are suggested to often write thank-you messages to thank others for their help.

Helper. Being the complement to *seekers*, a number of studies on public and internal online social spaces (Beck *et al.*, 2014) as well as KM research (Helms and Buijsrogge, 2005; Reinhardt *et al.*, 2011) indicate the role of the *helper*. *Helpers* answer information requests as part of *problem-solving* conversations (Richter and Riemer, 2013). Hence, they tend to reply to other persons' messages rather than to start new threads. They are likely to tag other people in their messages, for example, to refer the *seeker* to a contact person, or include URLs that could be of interest to the *seeker*. *Helpers* are suggested to participate in many threads and to most often receive thank-you messages because of providing valuable input.

Expert. The role *expert* exists in public online social spaces (Rowe *et al.*, 2013). Related to the roles of the *helper* and *solver* specified in Reinhardt *et al.* (2011), the *expert* answers information requests by others. Compared to the *helper*, however, the *expert* is suggested to hold more subject matter expertise and to be more experienced. Having a reputation for this expertise, the *expert* is often tagged in messages by others, for example, within *problem-solving* or *discussion and opinion* conversations (Richter and Riemer, 2013). The *expert* contributes to fewer threads than the *helper* and tends to write longer messages. The *expert* receives many thank-you messages and positive votes.

Networker. The role *networker* is related to online user roles, such as the *socialiser* (Füller *et al.*, 2014) and *social networker* (Welser *et al.*, 2009), and KM-related roles such as *boundary spanners* and *information brokers* (Cross and Prusak, 2002). As an ESN knowledge actor role, the *networker* is suggested to actively contribute to the network to establish and maintain connections in the ESN. On the one hand, the *networker* is likely to inform the community on their activities, for example, about their current task (Richter and Riemer, 2013). On the other hand, the *networker* will contribute short messages to, for example, *problem-solving* or *idea generation* conversations to express an opinion or to refer others to relevant contact persons. Further, the *networker* is suggested to engage in *informal talk*, for example, congratulating or praising other users (Richter and Riemer, 2013).

Linker. As a *reading* role, *linkers* are grounded in the knowledge worker roles *linker* and *learner* as specified by Reinhardt *et al.* (2011). As to online social spaces, they resemble *passive users* (Füller *et al.*, 2014), *readers* (Holtzblatt *et al.*, 2013) or *takers* (Cetto *et al.*, 2016). Not contributing any content to the platform themselves, *linkers* are suggested to retrieve information using the search feature of ESN platforms as well as by browsing various content items posted by others. Linking this information from different sources (Reinhardt *et al.*, 2011), they generate new information which may help them complete their work.

Observer. The role *observer* reflects the knowledge worker roles *controller* and *tracker* by Reinhardt *et al.* (2011). Compared to the specification of a *controller* by Reinhardt *et al.* (2011), however, the ESN knowledge actor role *observer* does not disseminate any information but remains passive. Like the *linker*, the *observer* is suggested to follow what is happening on the ESN. Yet, the *observer* does not explicitly search the ESN but rather keeps informed by following specific people and topics. *Observers* are more focused in their browsing activities than linkers.

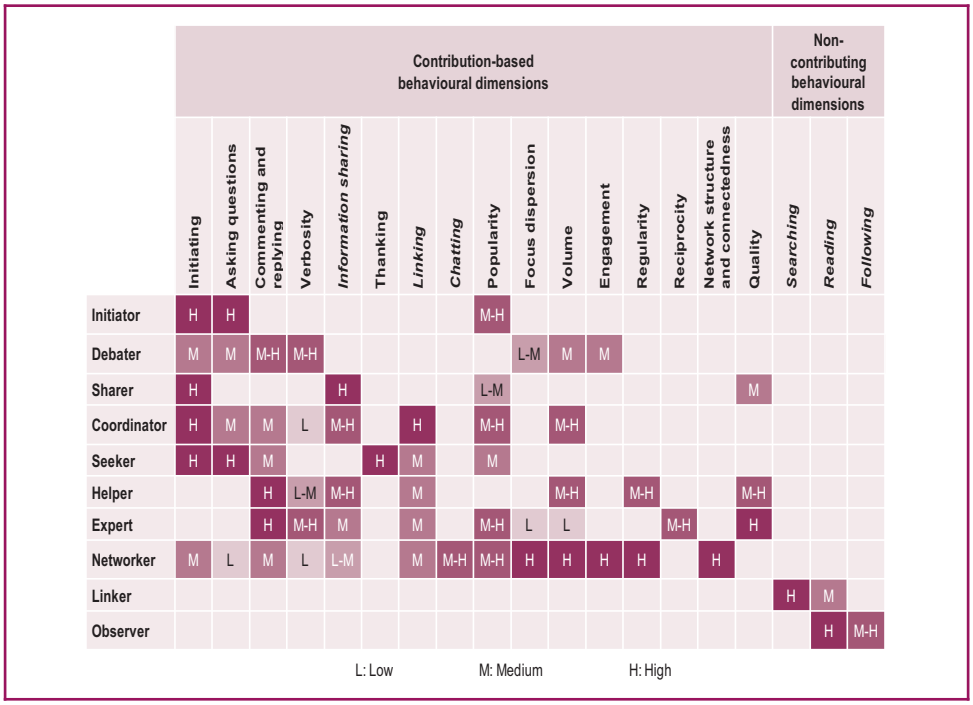
Based on the descriptions of the roles, Figure 4 depicts the mapping of the behavioural dimensions to the levels low, low to medium, medium, medium to high and high for the ten ESN knowledge actor roles.

4.2 Operationalisation of behavioural dimensions and identification of enterprise social network (ESN) knowledge actor roles

To be able to determine the extent to which users show a behavioural dimensions using ESN data, a set of metrics indicating the behavioural dimensions was derived. An overview of the behavioural dimensions and corresponding metrics is given in Table AII (appendix). In this regard, the metrics were adapted from metrics used to characterise user behaviour in online social spaces (Table I) so as to reflect the digital traces resulting from ESN use cases associated with a behavioural dimension (see Table AI). Most of the metrics are ratios allowing for the determination of proportions, and hence being able to identify behaviours characteristic of a certain role (Friemel, 2008).

The analysis of ESN data to identify ESN knowledge actor roles involves three steps. First, ESN data need to be exported from the application back end. The calculation of the metrics shown in Table AII requires access to log files indicating *contributing* and *reading* user activities as well as access to the content of messages (Behrendt *et al.*, 2014b). The exported data need to be imported into a database or spreadsheet software and prepared

Figure 4 Mapping of levels of behavioural dimensions to ESN knowledge actor roles



for the following analyses, for instance by extracting certain keywords such as "thanks" or question marks.

The second step concerns the calculation of the metrics shown in Table AII. In this regard, the ESN data analyst may have to adapt the specified metrics according to the features of the investigated platform and the available data (Rowe *et al.*, 2013). All metrics shown in Table AII need to be calculated for each individual user to be able to recognise the range of a metric, that is, minimum and maximum, and the distribution of a metric across all users in the data set.

Following the approach of explicit role discovery (Forestier and Stavrianou, 2012), individual users need to meet certain criteria to be assigned to a particular ESN knowledge actor role. In the ESN knowledge actor role framework, these criteria are represented by the levels of the behavioural dimensions related to a role. To determine whether a user meets these criteria, thresholds according to the levels *low*, *medium* and *high* need to be specified. On the one hand, the ESN data analyst can specify thresholds according to these levels for individual metrics (Table AII) indicating a particular behavioural dimension. These thresholds may be obtained by calculating statistical measures such as the average, mean and standard deviation of the measured variables for the user sample. Thus, a user has to show a *low*, *medium* or *high* value for all metrics indicating a particular behavioural dimension to be attributed a *low*, *medium*, or *high* score for this dimension as a whole. The *initiator*, for instance, is thought to score high on the behavioural dimension *initiating*, which is, among others, indicated by the metric *no. of initial messages created/no. of replies created*. Thus, to be assigned to the role *initiator*, a user has to show a significantly above average value for this metric. On the other hand, the metrics indicating a behavioural dimension can be transformed into composite scores, which represent the dimension as a whole. Thus, a user has to show a *low*, *medium* or *high* value for the composite score to be assigned to a role. Following one of these approaches, a user is assigned to none, one or several roles because an individual user could meet the criteria of none, one or several roles.

5. Discussion and future work

Drawing on findings from KM, research on roles in online spaces and ESN research, this article presents an ESN knowledge actor role framework. The framework includes ten ESN knowledge actor roles and describes the participation behaviour associated with the different roles. These behaviours are translated into a set of ESN metrics and criteria that a user has to meet to be assigned to a role.

The developed ESN knowledge actor role framework has implications for research and practice in the following areas:

- *Understanding knowledge-in-practice*: as outlined in Section 2.1, knowledge work often takes place in informal organisational structures (Allen *et al.*, 2007; Cross *et al.*, 2001), which are difficult to observe and to measure. The lack of transparency regarding these structures and the participating actors poses a challenge to the management of knowledge work. The ESN knowledge actor role framework offers an approach to identify different roles engaging in knowledge work and thus, the potential to better understand and manage the same (Hacker *et al.*, 2017a, 2017d).
- *Supporting organisational decision-making*: a notion of knowledge actor roles may usefully support decision-making in the areas of human resources management and KM, such as staffing decisions, succession planning and talent management (Hacker *et al.*, 2017a, 2017b; Hacker *et al.*, 2017d). In this regard, management might seek a candidate with a certain level of connectedness or tendency to initiate new ideas to fill a vacant position, for instance. As to succession planning, the role assumed on the ESN could be a criterion for finding a suitable successor, for instance, an individual exhibiting similar behaviours as the leaving employee. Furthermore, organisations can define critical roles according to their specific needs, and create targeted knowledge retention strategies.
- *Advancing ESN data analytics*: while ESN user behaviour has been analysed based on qualitative research designs (Richter and Riemer, 2013), the ESN knowledge actor role framework offers a quantitative approach to study user behaviour. As such, it facilitates analyses regarding the overall level of connectedness, level of communication between different business units and the analysis of role compositions in different departments, and thus a better understanding of platform engagement (Hacker *et al.*, 2017a). It further enables the monitoring of user behaviour and changes in the roles that individuals assume over time. In particular, sudden changes of individual use patterns could be tracked because these might indicate critical situations. Also, the framework enables further analyses and insights with regard to community health. As such, certain role compositions might be more beneficial to sustain and reinforce a healthy ESN community over time (Koch *et al.*, 2013; Rowe and Alani, 2012).
- *Improving ESN platform design*: the developed framework can inform the design of new and improvement of existing features of ESN platforms. ESN can be designed to suit different roles, for example, by aggregating platform news and trending posts for *linkers* or *observers* or by providing contact recommendations to *seekers*.

The results of this article need to be weighted up against its limitations. Specifically, the development of the role concepts and matching with the ESN use cases (Richter and Riemer, 2013) required some judgement and interpretation by the authors and is thus not entirely objective (Hacker *et al.*, 2017d). Yet, the goal of this article was to develop an ESN knowledge actor role framework on a conceptual basis. As such, it provides an approach for analysing roles in ESN using real data sets. While the results of such analyses might vary across different cases, the framework provides a generic set of roles which can be compared against the findings of empirical analyses. In this regard, empirical analyses allow for testing the applicability of the framework and the developed metrics. The

calculation of metrics using real data will help identify correlating, and thus, redundant metrics as well as overlapping roles. As a result, one might be able to reduce the number of metrics or adapt the framework by merging some of the roles. In case many users cannot be assigned to at least one role, one might have to adjust the criteria or define a new role. The determination of thresholds for the levels *low*, *medium* and *high* as well as deciding on a number of metrics per dimension and their corresponding levels that have to apply to an individual to be assigned to a certain role represent major tasks in applying and refining the framework.

The developed framework offers a number of possibilities for future work. For instance, users may assume different roles in different conversation spaces of the ESN. In this regard, one could compare user behaviour in the platform's main stream with the behaviour shown in groups. Also, users may change their behaviour and hence role, over time. Future research could consider the dynamics of ESN user behaviour and also, if given access to the required data, relate a user's role in the ESN with their position in the company's formal hierarchy, tenure or the level of maturity of the investigated platform. Finally, *reading*, that is consuming, roles should be investigated in more detail, for instance, to better understand the benefits that they draw from the platform and how this affects their *offline* networks.

6. Conclusions

Adopting the knowledge-in-practice perspective, this article has introduced a framework to identify knowledge actor roles in ESN. Many knowledge interactions in companies occur in informal organisational structures (Allen *et al.*, 2007) that are difficult to observe and to measure. ESN provide an alternative platform for knowledge-intensive interactions as well as record of these user activities. While prior research has investigated why and how users engage in ESN, little is known about the user roles emerging in ESN platforms.

Drawing on KM as well as social media research, the theoretical contributions of this article include a notion of the roles that users assume while communicating and shaping the knowledge embedded in ESN. The study moreover contributes to the emerging body of ESN data analytics by developing metrics to characterise ESN user behaviour, and hence, identify the specified roles. For practitioners, the detection of ESN knowledge actor roles can improve organisational knowledge transparency and inform decisions at the intersection between KM and human resources management.

Notes

1. This article is based on the doctoral thesis of the first author (Hacker, 2017). An earlier version of this article has been published as a working paper (Hacker *et al.*, 2017a).

2. Please refer to Hacker *et al.* (2017a) for details regarding the literature review on roles in online social spaces and to Viol and Hess (2016) regarding the review of IS literature on ESN. In this regard, the information in Section 3.2 is based on publications dealing with the metatopics *usage and behaviour* and *data and data analytics* as identified in the review.

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Appendix

Table AI Mapping ESN use cases and behavioural dimensions

		Associated behavioural dimensions							
ESN use case	*Activity*	*Initiating*	*Asking questions*	*Commenting and replying*	*Verbosity*	*Information sharing*	*Thanking*	*Linking*	*Chatting*
Discussion and opinion	Ask	x	x						
	Provide	x	x	x	x				
Idea generation	Ask	x	x						
	Provide			x					
Problem-solving	Ask	x	x				x		
	Provide			x	x	x		x	
Work coordination	Ask	x	x		x			x	
	Provide	x		x	x			x	
Event notifications	Provide	x			x	x			
Informal talk	Provide	x		x					x
Information storage	Provide	x				x		x	
Input generation	Provide	x				x			
Meeting organisation	Provide	x		x		x		x	
Social praise	Provide	x		x			x	x	
Status update	Provide	x	x		x				

Table AII Behavioural dimensions and corresponding metrics

Dimension	*Metrics*	*Example references*
Initiating	Number of status updates created/number of messages created Number of status updates created/number of replies created	Rowe *et al.* (2013), Viegas and Smith (2004)
Asking questions	Number of questions (in initial messages) created/number of (initial) messages created Number of threads starting with a question created/number of initial messages created Number of replies containing a question created/number of replies created	Furtado *et al.* (2013)
Commenting and replying	Number of replies created/number of messages created Number of replies created/number of status updates created Number of threads starting with a question contributed to/number of threads contributed to	Welser *et al.* (2007), Viegas and Smith (2004)
Verbosity	Average number of words/message created Average number of words/initial message created Average number of words/reply created	Junquero-Trabado and Dominguez-Sal (2012)
Information sharing	Number of status updates containing a URL created/number of status updates created Number of status updates containing a file created/number of status updates created Number of status updates containing numbers created/number of status updates created Number of replies containing a URL created/number of replies created Number of replies containing a file created/number of replies created Number of replies containing numbers created/number of replies created	Richter and Riemer (2013)
Thanking	Number of thanks messages created/number of messages created	Graham and Wright (2014)
Linking	Number of status updates containing a person tag created/number of status updates created Number of status updates containing a topic tag created/number of status updates created Number of replies containing a person tag created/number of replies created Number of replies containing a topic tag created/number of replies created Out-degree *(network based on following, replies, person tags)*	Richter and Riemer (2013)
Chatting	Number of messages containing emoticons created/number of messages created Number of messages containing congratulations created/number of messages created	Richter and Riemer (2013)
Popularity	Number of person tags received/number of replies received Number of unique users received replies from/number of replies received Number of person tags received from unique persons/number of tags received Number of threads created/no. of status updates created Average number of replies received/thread created Number of person tags received/total number of person tags created In-degree *(network based on following, replies, tags)*	Chan *et al.* (2010), Himelboim *et al.* (2009)

(*continued*)

Table AII

Dimension	*Metrics*	*Example references*
Focus dispersion	Average number of replies created/thread contributed to Number of threads contributed to/total number of threads	Chan *et al.* (2010), Rowe and Alani (2012)
Volume	Number of messages created Number status updates created Number of replies created Number of threads created Number of messages in groups created Degree centrality *(network based on replies)*	Holtzblatt *et al.* (2013), Viegas and Smith (2004), Smith *et al.* (2009)
Engagement	Number of unique users replied to/number of replies created Number of unique persons tagged/number of persons tagged	Rowe and Alani (2012), Rowe *et al.* (2013)
Regularity	Average number of active days/week *(month, year)* Average number of days that a user logged in/week *(month, year)*	Viegas and Smith (2004), Holtzblatt *et al.* (2013)
Reciprocity	Number of mutual relationships/number of unique relationships *(network based on replies)*	Angeletou *et al.* (2011)
Network structure and connectedness *(network edges based on e.g. replies, following, tagging)*	Degree centrality In-degree Out-degree Betweenness centrality Closeness centrality Clustering coefficient	Hansen *et al.* (2010), Junquero-Trabado and Dominguez-Sal (2012)
Quality	Average number of positive votes received/message created Number of thanks messages received/number of replies received	Füller *et al.* (2014), Rowe and Alani (2012)
Searching	Average number of search queries performed/day (*week, month, year*) Number of bookmarks	Benevenuto *et al.* (2009)
Reading	Average number of minutes spent reading (or browsing) content on the ESN/day (*week, month, year*)	Benevenuto *et al.* (2009)
Following	Number of persons followed/total number of registered persons Number of topics followed/total number of topic tags Out-degree (*network based on person tags*)	Holtzblatt *et al.* (2013)

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